WHAT IS CLAIMED IS:

1	1. A read channel, comprising:
2	an equalizer configured to equalize a digital signal to provide equalized
3	reproduced signals; and
4	a Viterbi detector capable of receiving the equalized reproduced signals and
5	converting the reproduced signals into a digital output signal indicative of data stored on
5	a recording medium;
7	wherein the equalizer is implemented using a coefficient learning circuit that
3	adaptively updates coefficients for the equalizer based upon a cosine function.
İ	2. The read channel of claim 1, wherein the coefficient learning circuit
2	adjusts coefficients using a tap coefficient update equation having a first parameter, k, for
3	modifying a magnitude response.
l	3. The read channel of claim 2, wherein the first parameter, k, is adjusted
2	according to $k=k-g*(f(a_{k+1})+f(a_{k-1}))*e_k$, where k is the cosine equalizer parameter for
3	modifying the magnitude response, g is an update attenuation gain, and e_k is an error
1	signal based on a difference between a noisy equalized signal and a desired noiseless
5	signal.
l	4. The read channel of claim 2, wherein the coefficient learning circuit
2	adjusts coefficients using a tap coefficient update equation having a second parameter, j,
3	for modifying a phase response.

- 1 5. The read channel of claim 4, wherein the second parameter, j, is adjusted
- 2 according to $j=j-g*(f(a_{k+2})+f(a_{k-2}))*e_k$, where j is the cosine equalizer parameter for
- 3 modifying the phase response, g is an update attenuation gain, and ek is an error signal
- 4 based on a difference between a noisy equalized signal and a desired noiseless signal.
- 1 6. The read channel of claim 1, wherein the coefficient learning circuit
- 2 adjusts coefficients using a tap coefficient update equation having a parameter, j, for
- 3 modifying a phase response.
- The read channel of claim 1, wherein the coefficient learning circuit
- 2 adjusts coefficients, w_i , according to $w_i=w_i-g^*f(a_{k-i})^*e_k$, where g is a provided update
- 3 attenuation gain and $f(a_{k-i})$ is based on the cosine function.
- 1 8. The read channel of claim 7, wherein $f(a_{k-i})$ is chosen to be $a_{k-i}-a_{k-i-2}$,
- 2 wherein written bits that are to be detected, a_{k-i} , are convolved with a PR4 response
- 3 based upon the cosine function.
- 1 9. The read channel of claim 7, wherein $f(a_{k-i})$ is chosen to be
- 2 $a_{k-i} + a_{k-i-1} a_{k-i-2} a_{k-i-3}$, wherein written bits that are to be detected, a_{k-i} , are convolved
- 3 with the EPR4 response based upon the cosine function.

l	10. The read channel of claim 7, wherein $f(a_{k-i})$ is chosen to be $a_{k-i}t_k$, wherein
2	written bits that are to be detected, a_{k-i} , are convolved with t_k based upon the cosine
3	function.
1	11. The read channel of claim 7, wherein $f(a_{k-i})$ is chosen to be $a_{k-i}h_k$, whereir
2	written bits that are to be detected, a_{k-i} , are convolved with h_k based upon the cosine
3	function.
1	12. A waveform equalizer that equalizes a waveform of a reproduction signa
2	obtained by reproducing marks and non-marks recorded on a recording medium,
3	comprising:
4	a delay element that delays a propagation of the reproduced signal;
5	a plurality of multipliers that multiply predetermined coefficients by the
6	reproduction signal and the delayed signal from the delay element;
7	a coefficient learning circuit that adaptively updates the predetermined
8	coefficients for each of the plurality of multipliers; and
9	an adder that adds outputs from the plurality of multipliers;
10	wherein the coefficient learning circuit adaptively updates coefficients for the
11	equalizer based upon a cosine function.
1	13. The waveform equalizer of claim 12, wherein the coefficient learning
2	circuit adjusts coefficients using a tap coefficient update equation having a first
3	parameter, k, for modifying a magnitude response.

1 14. The waveform equalizer of claim 13, wherein the first parameter, k, is 2 adjusted according to $k=k-g*(f(a_{k+1})+f(a_{k-1}))*e_k$, where k is the cosine equalizer 3 parameter for modifying the magnitude response, g is an update attenuation gain, and ek is an error signal based on a difference between a noisy equalized signal and a desired 4 5 noiseless signal. 1 15. The waveform equalizer of claim 13, wherein the coefficient learning circuit adjusts coefficients using a tap coefficient update equation having a second 2 3 parameter, j, for modifying a phase response. 1 16. The waveform equalizer of claim 15, wherein the second parameter, j, is 2 adjusted according to $j=j-g*(f(a_{k+2})+f(a_{k-2}))*e_k$, where j is the cosine equalizer parameter for modifying the phase response, g is an update attenuation gain, and \mathbf{e}_k is an error signal 3 based on a difference between a noisy equalized signal and a desired noiseless signal. 4 1 17. The waveform equalizer of claim 12, wherein the coefficient learning circuit adjusts coefficients using a tap coefficient update equation having a parameter, j, 2 3 for modifying a phase response. 1 18. The waveform equalizer of claim 12, wherein the coefficient learning circuit adjusts coefficients, w_i , according to $w_i=w_i-g*f(a_{k-i})*e_k$, where g is a provided

update attenuation gain and f(a_{k-i}) is based on the cosine function.

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1 19. The waveform equalizer of claim 18, wherein $f(a_{k-i})$ is chosen to be $a_{k-i}-a_k$. 2 $_{i-2}$, wherein written bits that are to be detected, a_{k-i} , are convolved with a PR4 response 3 based upon the cosine function. 1 20. The waveform equalizer of claim 18, wherein $f(a_{k-i})$ is chosen to be $a_{k\text{-}i}$ + $a_{k\text{-}i\text{-}1}$ - $a_{k\text{-}i\text{-}2}$ - $a_{k\text{-}i\text{-}3},$ wherein written bits that are to be detected, $a_{k\text{-}i}$, are convolved 2 3 with the EPR4 response based upon the cosine function. 1 21. The waveform equalizer of claim 18, wherein $f(a_{k-i})$ is chosen to be $a_{k-i}t_k$, 2 wherein written bits that are to be detected, a_{k-i} , are convolved with t_k based upon the 3 cosine function. 1 The waveform equalizer of claim 18, wherein $f(a_{k-i})$ is chosen to be $a_{k-i}h_k$, 22. wherein written bits that are to be detected, a_{k-i} , are convolved with h_k based upon the 2 3 cosine function. 1 23. A signal processing system, comprising: 2 memory for storing data therein; and 3 a processor, coupled to the memory, for equalizing a digital signal to provide

equalized reproduced signals, the processor adaptively updates coefficients for the

equalizer based upon a cosine function.

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1	24. The signal processing system of claim 23, wherein the processor adjusts	
2	coefficients using a tap coefficient update equation having a first parameter, k, for	
3	modifying a magnitude response.	
1	25. The signal processing system of claim 24, wherein the first parameter, k,	
2	is adjusted according to $k=k-g*(f(a_{k+1})+f(a_{k-1}))*e_k$, where k is the cosine equalizer	
3	parameter for modifying the magnitude response, g is an update attenuation gain, and ek	
4	is an error signal based on a difference between a noisy equalized signal and a desired	
5	noiseless signal.	
1	26. The signal processing system of claim 24, wherein the processor adjusts	
2	coefficients using a tap coefficient update equation having a second parameter, j, for	
3	modifying a phase response.	
1	27. The signal processing system of claim 26, wherein the second parameter,	
2	i, is adjusted according to $j=j-g*(f(a_{k+2})+f(a_{k-2}))*e_k$, where j is the cosine equalizer	
3	parameter for modifying the phase response, g is an update attenuation gain, and e_k is an	
4	error signal based on a difference between a noisy equalized signal and a desired	
5	noiseless signal.	
1	28. The signal processing system of claim 23, wherein the processor adjusts	
2	coefficients using a tap coefficient update equation having a parameter, j, for modifying a	a

phase response.

- 1 29. The signal processing system of claim 23, wherein the coefficient learning
- 2 circuit adjusts coefficients, w_i, according to w_i=w_i-g*f(a_{k-i})*e_k, where g is a provided
- 3 update attenuation gain and $f(a_{k-1})$ is based on the cosine function.
- 1 30. The signal processing system of claim 29, wherein $f(a_{k-i})$ is chosen to be
- a_{k-i} - a_{k-i-2} , wherein written bits that are to be detected, a_{k-i} , are convolved with a PR4
- 3 response based upon the cosine function.
- 1 31. The signal processing system of claim 29, wherein $f(a_{k-i})$ is chosen to be
- 2 $a_{k-i} + a_{k-i-1} a_{k-i-2} a_{k-i-3}$, wherein written bits that are to be detected, a_{k-i} , are convolved
- 3 with the EPR4 response based upon the cosine function.
- 1 32. The signal processing system of claim 29, wherein $f(a_{k-i})$ is chosen to be
- 2 $a_{k-i}t_k$, wherein written bits that are to be detected, a_{k-i} , are convolved with t_k based upon
- 3 the cosine function.
- 1 33. The signal processing system of claim 29, wherein $f(a_{k-i})$ is chosen to be
- $a_{k-i}h_k$, wherein written bits that are to be detected, a_{k-i} , are convolved with h_k based upon
- 3 the cosine function.

1	34. A magnetic storage device, comprising:
2	a magnetic storage medium for recording data thereon;
3	a motor for moving the magnetic storage medium;
4	a head for reading and writing data on the magnetic storage medium;
5	an actuator for positioning the head relative to the magnetic storage medium; and
6	a data channel for processing encoded signals on the magnetic storage medium,
7	the data channel comprising an equalizer configured to equalize a digital signal to
8	provide equalized reproduced signals and a Viterbi detector capable of receiving the
9	equalized reproduced signals and converting the reproduced signals into a digital output
10	signal indicative of data stored on a recording medium; wherein the equalizer is
11	implemented using a coefficient learning circuit that adaptively updates coefficients for
12	the equalizer based upon a cosine function.

- The magnetic storage device of claim 34, wherein the equalizer adjusts coefficients using a tap coefficient update equation having a first parameter, k, for modifying a magnitude response.
- The magnetic storage device of claim 35, wherein the first parameter, k, is adjusted according to k=k-g*(f(a_{k+1})+f(a_{k-1}))*e_k, where k is the cosine equalizer parameter for modifying the magnitude response, g is an update attenuation gain, and e_k is an error signal based on a difference between a noisy equalized signal and a desired noiseless signal.

The magnetic storage device of claim 35, wherein the equalizer adjusts 1 37. coefficients using a tap coefficient update equation having a second parameter, j, for 2 3 modifying a phase response. The magnetic storage device of claim 37, wherein the second parameter, j, 38. 1 is adjusted according to $j=j-g*(f(a_{k+2})+f(a_{k-2}))*e_k$, where j is the cosine equalizer 2 parameter for modifying the phase response, g is an update attenuation gain, and ek is an 3 error signal based on a difference between a noisy equalized signal and a desired 4 5 noiseless signal. The magnetic storage device of claim 34, wherein the equalizer adjusts 1 39. coefficients using a tap coefficient update equation having a parameter, j, for modifying a 2 3 phase response. 1 40. The magnetic storage device of claim 34, wherein the coefficient learning circuit adjusts coefficients, w_i, according to w_i=w_i-g*f(a_{k-i})*e_k, where g is a provided 2 3 update attenuation gain and $f(a_{k-i})$ is based on the cosine function. 1 41. The magnetic storage device of claim 40, wherein $f(a_{k-1})$ is chosen to be a_{k-i} - a_{k-i-2} , wherein written bits that are to be detected, a_{k-i} , are convolved with a PR4 2

response based upon the cosine function.

1	42. The magnetic storage device of claim 40, wherein $f(a_{k-i})$ is chosen to be
2	$a_{k-i} + a_{k-i-1} \cdot a_{k-i-2} - a_{k-i-3}$, wherein written bits that are to be detected, a_{k-i} , are convolved
3	with the EPR4 response based upon the cosine function.
1	43. The magnetic storage device of claim 40, wherein $f(a_{k-i})$ is chosen to be a_k .
2	$_{i}t_{k}$, wherein written bits that are to be detected, a_{k-i} , are convolved with t_{k} based upon the
3	cosine function.
1	44. The magnetic storage device of claim 40, wherein $f(a_{k-i})$ is chosen to be a_k .
2	$_{i}h_{k}$, wherein written bits that are to be detected, a_{k-i} , are convolved with h_{k} based upon the
3	cosine function.
1	45. A read channel, comprising:
2	means for equalizing a digital signal to provide equalized reproduced signals; and
3	means, coupled to the means for equalizing, for receiving the equalized
4	reproduced signals and converting the reproduced signals into a digital output signal
5	indicative of data stored on a recording medium;
6	wherein the means for equalizing is implemented using means for adaptively
7	updating coefficients for the means for equalizing based upon a cosine function.

1	46. A waveform equalizer that equalizes a waveform of a reproduction signal
2	obtained by reproducing marks and non-marks recorded on a recording medium,
3	comprising:
4	means for delaying propagation of a reproduced signal;
5	means for multiplying predetermined coefficients by the reproduced signal and
6	the delayed signal from the means for delaying;
7	means for adaptively updating the predetermined coefficients for the means for
8	multiplying; and
9	means for adding outputs from the means for multiplying;
10	wherein the means for adaptively updating the predetermined coefficients updates
11	the predetermined coefficients based upon a cosine function.